# Emergency Action Plans

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# Why an EAP is Important

## Dam Failures Do Occur

No one knows precisely how many dams have failed in the US
**from January 1, 2005 through June 2013**
**All State Dam Safety programs have documented failures**

**From this the Association of State Dam Safety Officials**

Reported

**173 dam failures and 587 "incidents"**

"incidents" being episodes that without intervention,
would likely have resulted in dam failure

# But that is in the entire US
# It probably won't happen in NC

Feb 22, 1976: New-Found Creek Dam Buncombe Co. (near Canton, NC)
**Family of 4 Died**

Sept. 15, 1989: Evans/Lockwood Dams Fayetteville, NC (due to overtopping)
**2 Children died**

Sept. 1999: **40** failures in NC due to Hurricane Floyd

May 26, 2003: Hope Mills Dam NC estimated $2.1 million in damages, 1600 people evacuated & estimated $6 million to rebuild (due to stuck dam gate & heavy rain)

May 27, 2003: Lake Upchurch and McLaughlin Lake dams NC 4 additional dams damaged, another 16 overtopped

April 25, 2011: Carolina Lake Dam Moore County (breach along principal spillway)

# How Can an EAP Help?

1. **It identifies potential emergency conditions that can occur**
   Landowner should be aware of prominent types of failure and their telltale signs (3 general categories of failure: Overtopping, Seepage & Structure)

1. **Defines responsibilities and procedures for each potential condition for all 3 levels of emergency**
   3 Emergency Levels (Green, Yellow & Red) will be covered later

2. **Provides Contacts and numbers for the 3 emergency levels**

3. **Provides locally available resources with phone numbers for Equipment, Materials & Labor should the need arise**

# EAP Templates

## 2 Templates

1. NC DSWC EAP document : **12** Pages

   This should be used for Low or Intermediate Hazard Dams
   This EAP is a simplified version of the NCDENR EAP.
   It can be found on the divisions website/Technical Services/Planning and design tools Under "Pond Design"
   http://www.ncagr.gov/SWC/tech/onlinedesigntools.html

2. NC DENR LQ EPA document: 68 Pages

   This should be used for High Hazard Dams
   This document can be located at:
   http://portal.ncdenr.org/web/lr/dams
   Under "Planning for a Dam Emergency"

# How Do I Determine My Dams Hazard?

# Hazard Class

3 Hazard Classes
As Defined by
NC DEMLR Dam Safety Section

## A- Low Hazard Dam

## B- Intermediate Hazard Dam

## C- High Hazard Dam

DEMLR Hazard forms can be found on the Division Web site
Under Pond planning and Design
http://www.ncagr.gov/SWC/tech/onlinedesigntools.html

# A- Low Hazard Dam

A - **Low** Dams located where failure may damage uninhabited low value non-residential buildings, agricultural land, or low volume roads.

| Hazard Classification | Quantitative Guidelines |
|---|---|
| Interruption of road service | Less than 25 vehicles/day |
| Low Road Volume | Less than 25 vehicles/day |
| Economic Damage | Less than $30,000 |

# B- Intermediate Hazard Dam

B –Intermediate Dams located where failure may damage highways or secondary railroads, cause interruption of use or service of public utilities, cause minor damage to isolated homes, or cause minor damage to commercial and industrial buildings. Damage to these structures will be considered minor only when they are located in back water areas not subjected to the direct path of the breach flood wave; and they will experience no more than 1.5 feet of flood rise due to breaching above the lowest ground elevation adjacent to the outside foundation walls or no more than 1.5 feet of flood rise due to breaching above the lowest floor elevation of the structure, the lower of the two elevations governing. All other damage potential will be considered serious.

| Hazard Classification | Quantitative Guidelines |
|---|---|
| Damage to Highways Interruption of Service | 25 to less than 250 vehicles/day |
| Economic damage | $30,000 to less than $200,000 |

# C- High Hazard Dam

C - High Dams located where failure will likely cause loss of life or serious damage to homes, industrial and commercial buildings, important public utilities, primary highways, or major railroads.

| Hazard Classification | Quantitative guidelines |
|---|---|
| Loss of Life | Probable loss of 1 or more human lives |
| Economic Damage | More than $200,000 |
| Probable loss of human life due to breached roadway or bridge on or below dam | 250 or more vehicles per day |

# Emergency Action Plan

Although it may seem daunting at first,
if broken down into its 4 major steps

IT'S NOT SO BAD!!!!

Step 1: Event Detection and Level Determination

Step 2: Notification and Communication

Step 3: Expected Actions

Step 4: Termination and Follow up

# STEP 1

**Step 1 - Event Detection and Level Determination**
During the initial step, an unusual event or emergency event is detected at the dam and classified by the *(EAP Coordinator or designee)* into one of the following event levels:

Event Level 1, RED: Urgent!! Emergency Event, Dam failure imminent or is in progress

Event Level 2, YELLOW: Emergency Event, potential dam failure situation, rapidly developing

Event Level 3, GREEN: Unusual Event, slowly developing

Emergency level definitions and Appendix B can be used to help the *EAP Coordinator or designee* determine which of the above event levels is applicable.

Levels are numbered and color coded to prevent confusion
BELIEVE IT OR NOT
IT DOES HELP

# STEP 1 BREAKDOWN

First things First
Who is the EAP Coordinator or Designee

Who is the key decision maker responsible for initiating an EAP?

A: Soil and Water Conservation

B: Local Emergency Management

C: The governor

D: The dam owner

THE OWNER MAY DESIGNATE RESPONSIBILITES IF THEY ARE NOT COMFORTABLE OR UNTIL THEY BECOME COMFORTABLE MAKING THE CALLS

# Step 1
# Emergency Levels
## Event Level 1, RED:

- Urgent!!! Dam failure imminent or is in progress and cannot be prevented
- Evacuation is necessary

### Examples

Spillway flowing with advancing head cutting that is threatening the control section of the auxiliary spillway.

Earthen dam is overtopping

Sinkhole is enlarging rapidly

# Step 1 (cont.)
# Emergency Levels

## Event Level 2: Yellow

- Potential dam failure situation, rapidly developing

- Situation could lead to dam failure, but there is not an immediate threat of dam failure

  - Monitoring is necessary
  - Evacuation may become necessary

### Examples

Spillway flowing with active gully erosion
Reservoir level 1 foot below the top of dam (within the structural freeboard)
Cracks in the embankment with seepage

# Step 1 (cont.)
# Emergency Levels

## Emergency Level 3: Green

- Unusual event , slowly developing
- Situation has not yet threatened the operation or structural integrity of the dam

## Examples

New seepage area (clear flow)

New crack in the embankment without seepage or sliding

Auxiliary spillway flowing with no active erosion

# APPENDIX B
# EVENT LEVEL DETERMINATION GUIDANCE

| Event | Condition | Emergency level* |
|---|---|---|
| | | |
| Earth spillway flow | Reservoir water surface elevation at auxiliary spillway crest or spillway is flowing with no active erosion | 3 |
| | Spillway flowing with active gully erosion | 2 |
| | Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise | 2 |
| | Spillway flowing with an advancing headcut that is threatening the control section | 1 |
| | Spillway flow that is flooding people downstream | 1 |
| Embankment overtopping | Reservoir level is 1 foot below the top of the dam | 2 |
| | Water from the reservoir is flowing over the top of the dam | 1 |
| Seepage | New seepage areas in or near the dam | 3 |
| | New seepage areas with cloudy discharge or increasing flow rate | 2 |
| | Seepage with discharge greater than 10 gallons per minute | 1 |
| Sinkholes | Observation of new sinkhole in reservoir area or on embankment 2 | 2 |
| | Rapidly enlarging sinkhole | 1 |
| Embankment cracking | New cracks in the embankment greater than ¼-inch wide without seepage | 3 |
| | Cracks in the embankment with seepage | 2 |

# Step 2
# Notification and Communication

After the owner has determined the appropriate event Level they should make contacts

Appendix C : Level 1, RED ONLY: Residents business at risk
Appendix D: Emergency Service Contacts of all 3 Levels
Appendix E: Locally Available Resources (Equipment, Labor etc…)

Just think of it as the emergency numbers you leave with a baby sitter

When we are in an emergency we can never think of who to call or their numbers

# APPENDIX C

## Residents/Businesses/Roads/Infrastructure at Risk

A brief summary and contact information for entities within the hazard zone.

All should be notified if: Level 1, RED Emergency:

(Use additional sheets if necessary)

| Entity No. | Resident/business/roads or other impacted entity | Property Address | Phone No. with area code | Distance downstream from dam (mi) |
|---|---|---|---|---|
| X | Name of entity | Address/location of entity | XXX-XXX-XXXX | Distance from dam |
| X | Name of entity | Address/location of entity | XXX-XXX-XXXX | Distance from dam |
| X | Name of entity | Address/location of entity | XXX-XXX-XXXX | Distance from dam |
| X | Name of entity | Address/location of entity | XXX-XXX-XXXX | Distance from dam |

# APPENDIX D
# Emergency Service Contacts

## Level 3, GREEN Unusual Event

| Agency / Organization | Principal Contact | Address | Office Phone No. with Area Code | Alternate Telephone Numbers |
|---|---|---|---|---|
| Owner/Representative of Name of Dam | Name of owner | Contact Address | XXX-XXX-XXXX | XXX-XXX-XXXX (H)<br>XXX-XXX-XXXX (C) |
| Local Soil and Water Conservation District Office | Contact Name | Contact Address | XXX-XXX-XXXX | XXX-XXX-XXXX (H)<br>XXX-XXX-XXXX (C) |
| Design Engineer | Contact Name | Contact Address | XXX-XXX-XXXX | XXX-XXX-XXXX (H)<br>XXX-XXX-XXXX (C) |

## Level 2, Yellow Emergency

In addition to contacting Agencies and Organizations for Level 3, Green Unusual Event these additional contacts shall be made **IF downstream hazard exist**

| Agency / Organization | Principal Contact | Address | Office Phone No. with Area Code | Alternate Telephone Numbers |
|---|---|---|---|---|
| County Emergency Management Director | Name of Director | Contact Address | XXX-XXX-XXXX | XXX-XXX-XXXX (C) |

# APPENDIX D (Cont)

## Level 1, RED Emergency:

In addition to contacting Agencies and Organizations for Level 3, GREEN Unusual Event and Level 2, YELLOW Emergency these additional contacts shall be made **IF downstream hazards exist** (Appendix C)

| Agency / Organization | Principal Contact | Address | Office Phone No. with Area Code | Alternate Telephone Numbers |
|---|---|---|---|---|
| XXXX County Sheriff | Sheriff's Name | Contact Address | XXX-XXX-XXXX | XXX-XXX-XXXX (C) |
| Local Fire Department | Contact Name | Contact Address | XXX-XXX-XXXX | XXX-XXX-XXXX |
| Local Police | Contact Name | Contact Address | XXX-XXX-XXXX | XXX-XXX-XXXX |
| Local Highway Patrol | Contact Name | Contact Address | XXX-XXX-XXXX | XXX-XXX-XXXX |

# Step 3
# Expected Actions

After the initial notifications are made, the *(EAP Coordinator or designee)* should confer with the *(Design Engineer or designee) and the local soil and water conservation district office* to develop and execute appropriate preventative actions. During this step of the EAP, there is a continuous process of taking actions, assessing the status of the situations, and keeping others informed through communication channels established during the initial notifications. The EAP may go through multiple event levels during Steps 2 and 3 as the situation either improves or worsens.

# Step 4
# Termination & Follow-Up

Once the event has ended or been resolved, termination and follow-up procedures should be followed as outlined in Section 4 of this EAP. EAP operations can only be terminated after completing operations under Event Level 3 or 1. If Event Level 2 is declared, the operations must be designated Event Level 3 or 1 before terminating the EAP operations.

# What should be done after the Emergency?

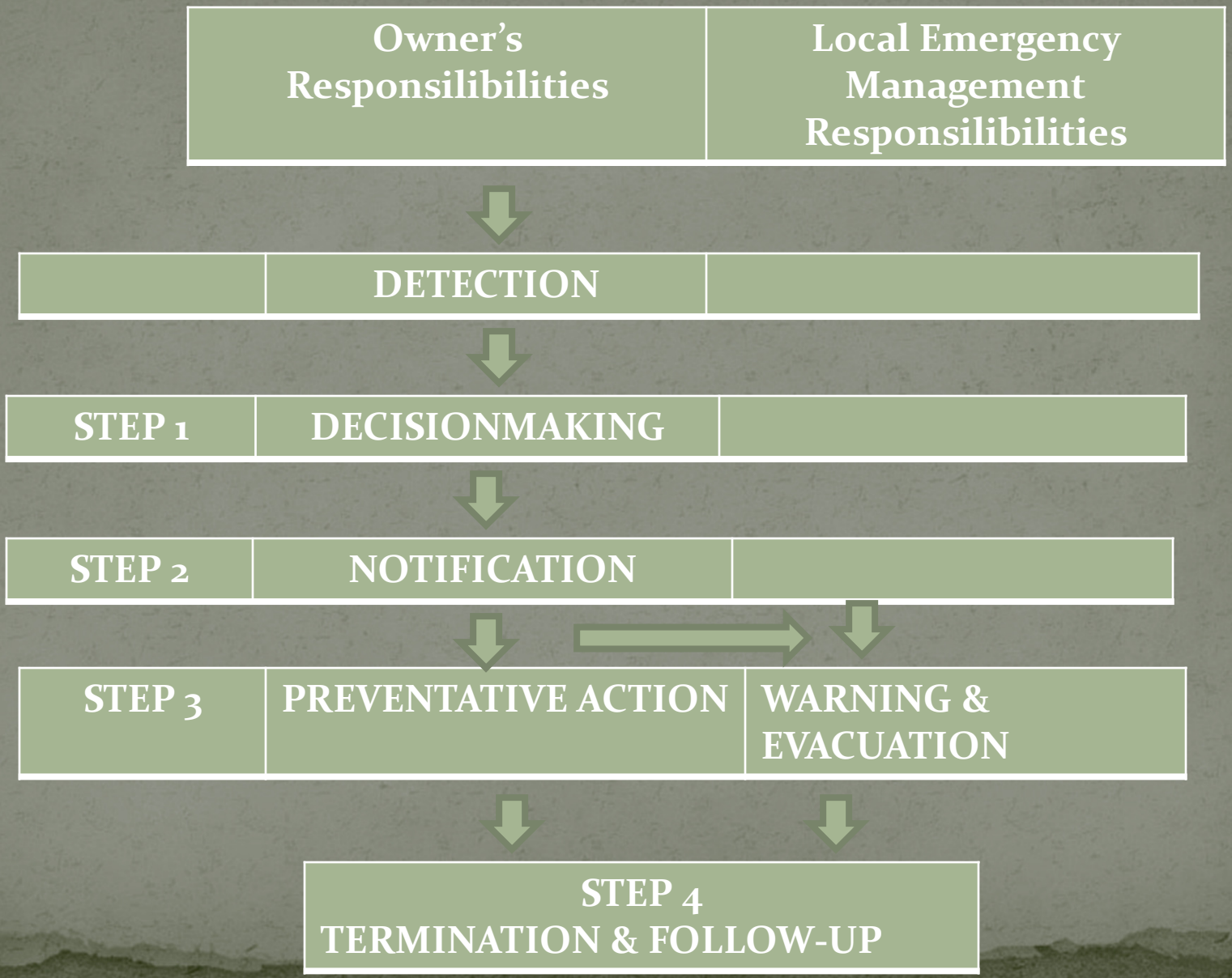
Terminate the EAP

Hold a Follow up meeting

If necessary, Stabilize the area

Develop a repair plan if necessary

# Summary of Responsibilities



# EAP IS A LIVING DOCUMNET

It must be undated periodically (YEARLY) to have the greatest effectiveness

What should be tested/checked/updated?

- Hazard should be checked and verified
- Call all contacts to verify phone number and contact person name
- Owner verifies that contact person can find EAP

GOT IT ??

THEN LETS LOOK AT SOME PICTURES OF MOST COMMON FAILURES

# Carolina Lake Dam (NC) (April 25, 2011) Structural Failure

Breach along principal spillway

# Carolina Lake Dam (NC) (April 25, 2011) Structural Failure

# Carolina Lake Dam (NC) (April 25, 2011) Structural Failure

# Overtopping

Picture from Association of State Dam Officials

http://www.damsafety.org/media/Documents/Images-Animations/Dam%20Animations/Overtopping.wmv

# Seepage

Picture from Association of State Dam Officials

http://www.damsafety.org/media/Documents/Images-Animations/Dam%20Animations/Piping.wmv